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DESCRIPTIONS OF LARVAL *STENICHNUS* (*CYRTOSCYDMUS*): *S. TURBATUS* AND *S. CONJUX*, WITH NOTES ON THEIR NATURAL HISTORY (COLEOPTERA: SCYDMAENIDAE)

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Abstract.—Larvae of *Stenichnus turbatus* Casey and *Stenichnus conjux* Casey are tenatively associated with adults from berlese extracts of samples of sifted, dry, decaying wood in upstate New York. Both species belong to the subgenus *Cyrtoscydmus* Motschulsky. They do not differ significantly in size, but differ consistently in several chaetotaxic characters which are correlated. We present a detailed description of *S. turbatus* larvae, including illustrations, and compare *S. conjux* larvae which differ in the absence of several structures. Some notes on the natural history of each species are given.

There are few published references to larvae of Scydmaenidae (see Brown and Crowson, 1979, and references therein). For North America, there are only illustrations of *Eumicrus longicollis* Casey and a species assigned to *Euconnus* by Brown and Crowson (1979), both of which were illustrated by Boving and Craighead (1931; cf. plates 16 and 19). Thus, collection of larvae of *Stenichnus* during recent field studies near Ithaca, New York, presented an opportunity to describe two Nearctic scydmaenid larvae as a basis for future studies of these predatory staphylinoid beetles. Both species belong to the subgenus *Cyrtoscydmus* which includes the European species, *S. collaris* (Müller and Kunze) and *S. pusillus* (Müller and Kunze), for which larvae are described (cf. Brown and Crowson, 1979; Paulian, 1941).

We first collected *Stenichnus* larvae (*S. turbatus* Casey and *S. conjux* Casey) from debris and litter in a hollow tree which contained dry, decaying wood and a mouse nest. These materials were sifted and berlesed, and the residue stored in 70% ethanol. Larvae were cleared in Nesbitt's Solution and mounted directly into Hoyer's Medium. A Leitz Dialux-20 compound microscope equipped with differential interference-contrast illumination and a drawing attachment was used to study and illustrate the larvae with magnifications up to 1000×. We identified the larvae to the genus *Stenichnus* with a recent key by Brown and Crowson (1979). Dr. Walter Suter identified the associated adult female as *S. conjux*. A total of six larvae were collected with this female (three *S. conjux*; three *S. turbatus*), with the following collection data: New York, Tioga Co., ca. 2 miles NW Richford, 28 October 1980, J. P. & Q.W. collrs, ex hollow tree with mouse nest, Q.W. Lot #8074. Two larvae, one *S. conjux* and one *S. turbatus*, were sifted from

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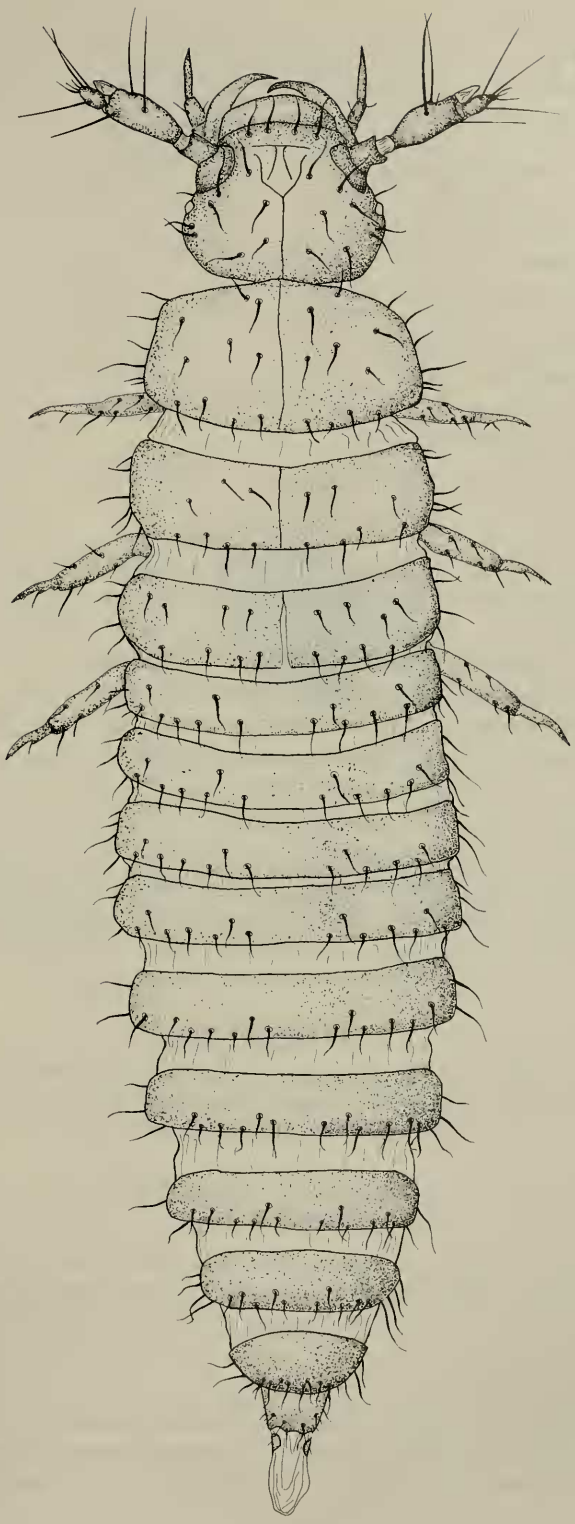


Fig. 1. *Stenichnus turbatus,* larval habitus (dorsal), Tioga County, New York.

Table 1. Measurements (in mm) of selected structures of larvae of *Stenichnus turbatus*.

Structure	Range	Mean
Body length (apex nasale to apex of abdominal segment X)	1.39–1.77	1.57
Metanotum length/metanotum width	.072/.303–.090/.356	.082/.328
Pronotum length/pronotum width	.159/.274–.179/.313	.167/.287
Head length/head width (length at midline/ width at widest point)	.169/.213–.200/.233	.185/.221
Mandible length (along imaginary axis described in text)	.082–.090	.086
Antennal length: antennomere II	.079–.090	.087
antennomere III	.038–.044	.042
Antennal width: antennomere II	.041–.044	.042
Tarsungulus length (along imaginary axis from inner base to apex)	.064–.072	.068

a decaying log with the same data as above. A third series was later collected which included five larvae (all *S. turbatus*) associated with adults, with the following data: New York, Tompkins Co., Ithaca, 9 May 1981, J.P. collr., J.P. Lot #038. Voucher specimens of adults and larvae are deposited in the Cornell University Insect Collections, and representatives retained by J.P.

The following description is based primarily on the Tioga County specimens of *S. turbatus,* and all of the illustrations were made from them. The SEM (Fig. 19) was made from a critical point dried specimen of *S. turbatus* from the "Ithaca" series. Specimens from Q.W. Lot #8074 and J.P. Lot #038 agreed in all characters compared. The identity of *S. turbatus* larvae rests on the association of adults and larvae in J.P. Lot #038, while *S. conjux* larval determination is based on associated adults in the other series combined with elimination of supposed *S. turbatus* larvae. A discussion of *Stenichnus* larvae follows the descriptions.

Descriptions of Larval *Stenichnus*

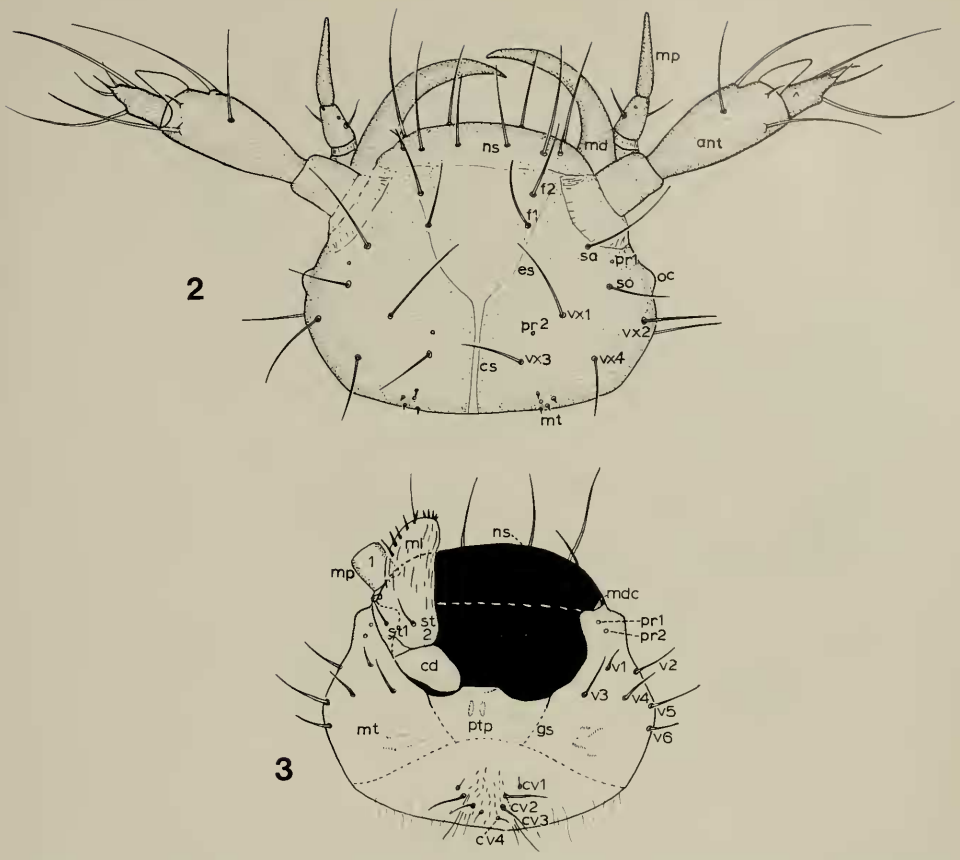
All observed chaetotaxic characters are present in *S. turbatus,* and all differences seen in *S. conjux* involve the absence of some of these structures. We describe and illustrate *S. turbatus* first, followed by noted differences observed in *S. conjux.* Measurements of selected structures are given in Table 1.

***Stenichnus turbatus* Casey**

Figs. 1–19

With characters of Staphylinoidea (Crowson, 1955), except urogomphi absent; Scydmaenidae (Crowson, 1955); and *Stenichnus* (Brown and Crowson, 1979). Length of midline ca. 1.5 mm ($\bar{x}$ from Table 1); body elongate (Figs. 1, 19), widest at metanotum, gradually narrowed posteriorly; terga wider than sterna, body somewhat onisciform (Fig. 19).

Cranium (Figs. 2, 3). Length (midline)/width (broadest) ca. 0.8; with single pair of ocelli. Coronal suture distinct, long. Epicranial sutures straight, poorly defined anteriorly. Two dorsal and 2 ventral pairs of pores; and 4 vertical, 1 supraantennal,



Figs. 2, 3. *Stenichnus turbatus,* larval head. 2, Dorsal view. 3, Ventral view. *ant* = antenna; *cd* = cardo; *cs* = coronal suture; *cv1-cv4* = cervical setae; *es* = epicranial suture; *f1–f2* = frontal setae; *gs* = gular suture; *md* = mandible; *mdc* = mandibular condyle; *ml* = mala; *mt* = microtrichia (e); *mp* = maxillary palpus; *ns* = nasale; *oc* = ocellus; *pr1–pr2* = pores; *ptp* = posterior tentorial pit; *sa* = supraantennal seta; *so* = supraocellar seta; *st1–st2* = stipes setae; *v1–v6* = ventral setae; *vx1–vx4* = vertical setae.

1 supraocellar, 2 frontal, and 6 ventral pairs of setae. Posterior tentorial pits proximal; gular sutures distinct anteriorly, gula short. Microtrichiae present laterad to gula. Cervical membrane ventrally with 4 pairs of setae (middle 2 pairs larger).

Antenna (Fig. 4): Large, prominent (Figs. 1, 2). Sensory appendage large, pointed, anterodorsal relative to antennomere III. Antennomere I short, broad, with 3 dorsal and 2 ventral pores near apex. Antennomere II very long ($\bar{x}$ ca. 0.087 mm), robust, with 3 large and 2 smaller setae; width ($\bar{x}$) ca. 0.042 mm. Antennomere III small ($\bar{x}$ length ca. 0.042 mm), apex terminating in pointed apical process; with 6 setae (Fig. 4).

Nasale and epipharynx (Fig. 7): Nasale transverse, with 2 pairs of large, anterior setae, and 4 pairs of dorsal setae (2 pairs large, 2 pairs smaller). Epipharynx membranous, with 2 pairs of pores and 4 pairs of setae (lateral setae larger), and various microtrichiae.

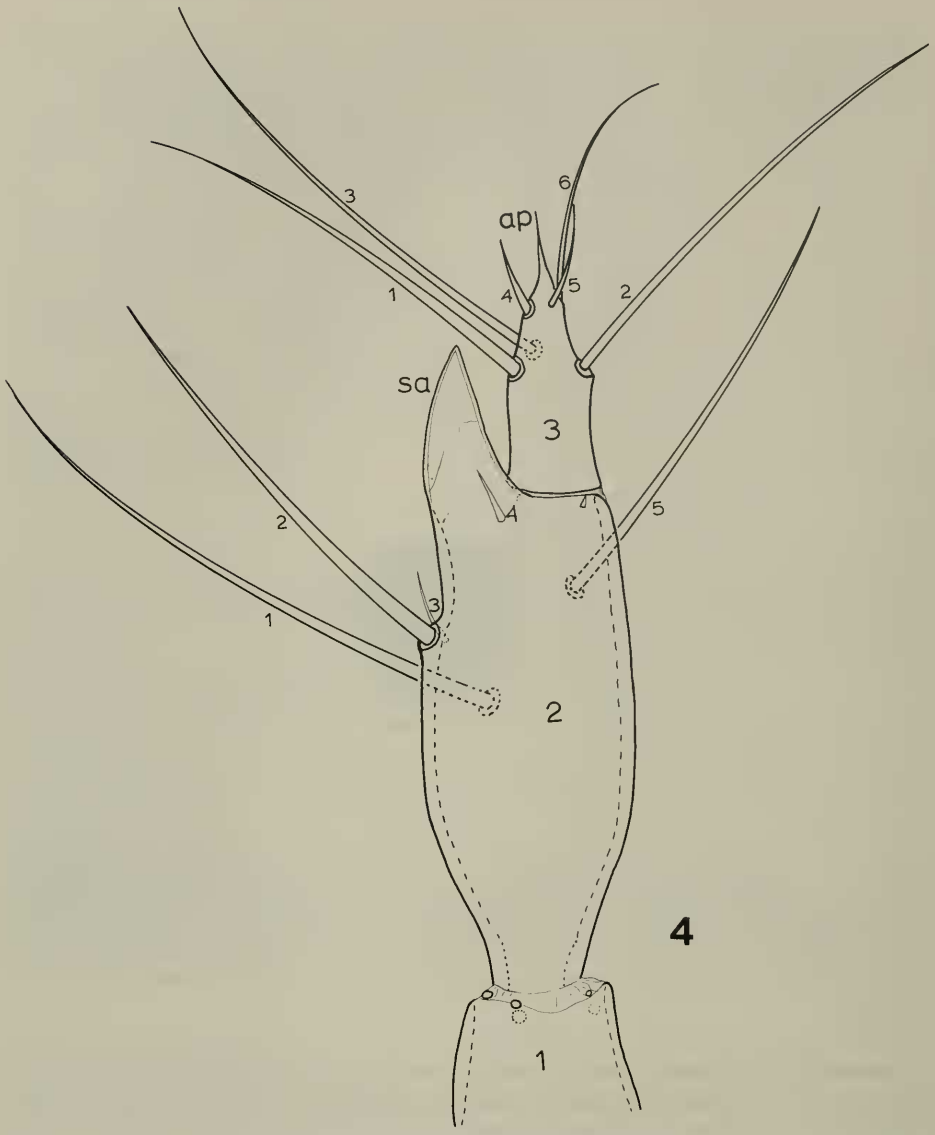
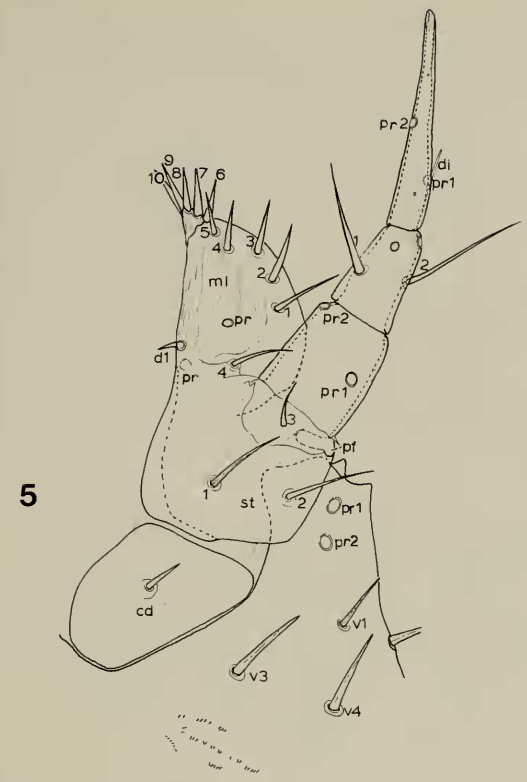
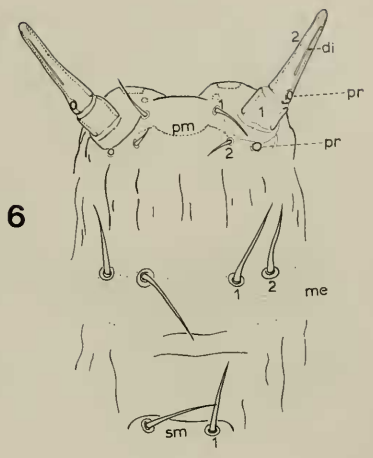


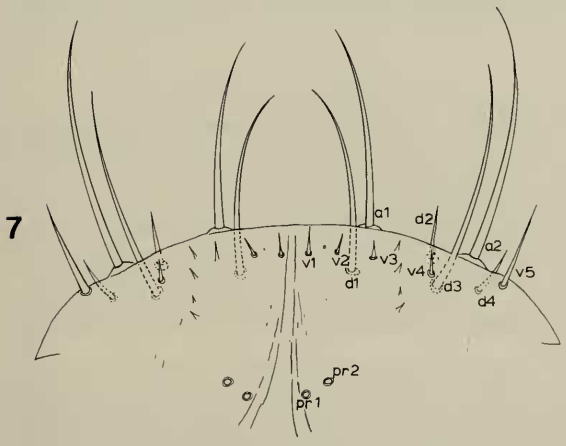
Fig. 4. *Stenichnus turbatus*, larval antenna; large numbers are segments; small numbers are setae; *ap* = apical process; *sa* = sensory appendage.

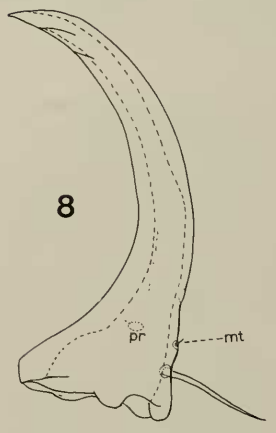
Mandible (Fig. 8): Mandible falcate, long, narrow, pointed; with single dorsal pore, large basolateral seta, and single lateral microtrichia; $\bar{x}$ length ca. 0.086 mm, measured along imaginary axis drawn from inner margin of base to apex.

Maxilla (Fig. 5): Cardo simple, quadrangular, with single seta. Stipes short, broad, with 2 setae on disc, 2 setae at anterior margin near bases of mala and palpus, and 1 pore at base of mala. Palpifer small. Palpus trimerus. Palpomere I with 2 ventral pores. Palpomere II with 2 setae and 2 pores (1 apicoventral, 1

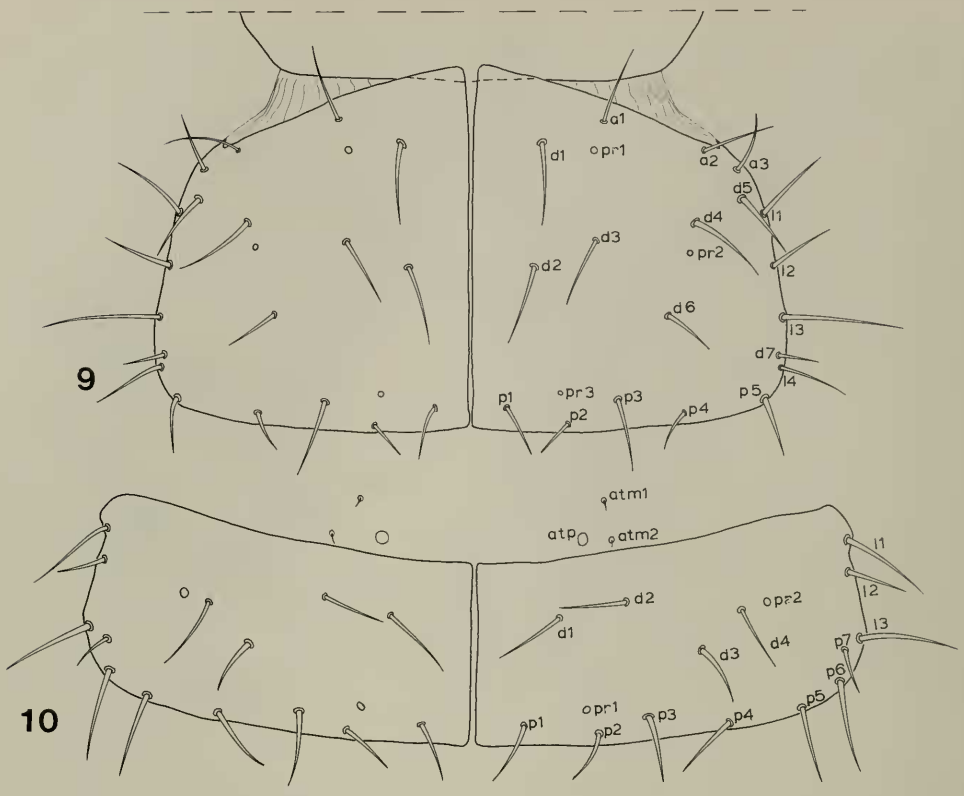








Figs. 5–8. *Stenichnus turbatus,* larval mouthparts. 5, Maxilla (left, ventral). 6, Labium (ventral). 7, Nasale (ventral). 8, Mandible (left, ventral). *a* = anterior seta; *cd* = cardo; *d* = dorsal seta; *di* = digitiform sensillum; *me* = mentum; *ml* = mola; *mt* = microtrichia(e); *pm* = prementum; *pr* = pore; *sm* = submentum; *v* = ventral seta.

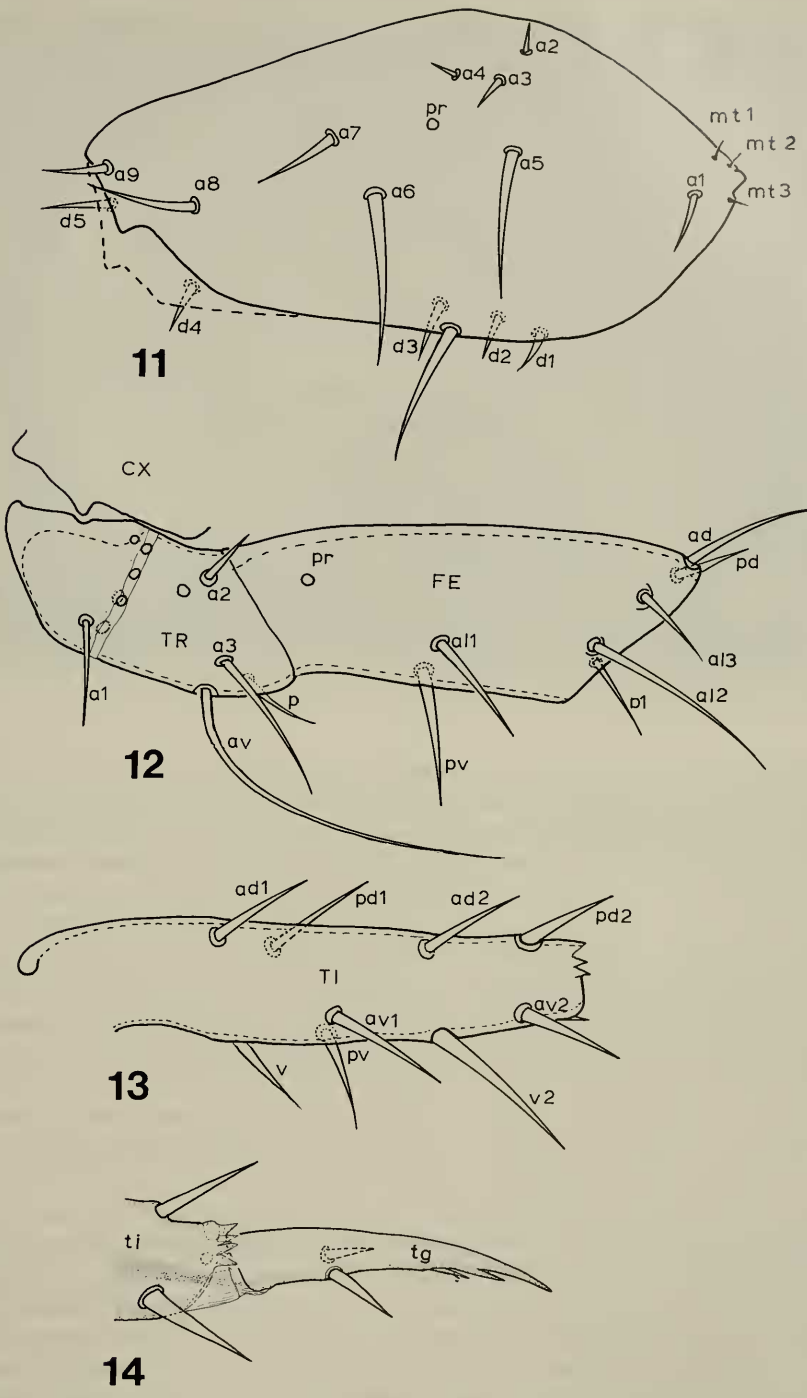


Figs. 9, 10. *Stenichnus turbatus,* larval thoracic nota. 9, Pronotum. 10, Metanotum. *a* = anterior seta; *atm* = acrotergal microtrichia; *atp* = acrotergal pore; *d* = dorsal seta; *l* = lateral seta; *p* = posterior seta; *pr* = pore.

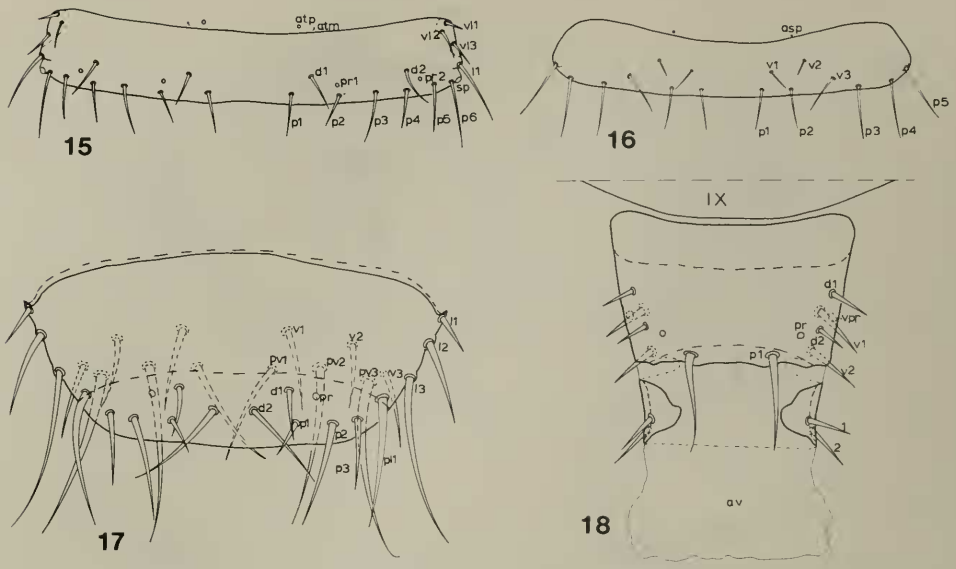
apicolateral), narrower than I but similar in length. Palpomere III long, thin, narrowed apically with single digitiform sensillum dorsally, 1 dorsal seta, and 2 pores (1 ventromedial near middle, 1 dorsolateral near base).

Labium (Fig. 6): Largely membranous. Submentum with 1 seta. Mentum with 2 pairs of setae. Prementum without clearly defined sclerite, with 2 pairs of setae and 1 pair of pores. Palpus bimerous. Palpomere I short, simple. Palpomere II long, thin, narrowed apically, with dorsal digitiform sensillum and basolateral pore. Ligula absent.

Thorax (Figs. 9, 10): Pronotum evenly divided into 2 plates; almost twice as wide as long (ca. 1.7×), broadest at posterior angle; with 19 pairs of setae (cf. Fig. 9: 3 anterior, 7 dorsal, 4 lateral, and 5 posterior pairs) and 3 pairs of pores (pr1 proximal to a1; pr2 to d4; and pr3 to p2). Mesonotum about 4× as wide as long, dorsum divided into 2 plates; with 14 pairs of setae (Fig. 10: 4 dorsal, 3 lateral, and 7 posterior pairs) and 2 pairs of pores (pr1 proximal to p2, pr2 to d4); acrotergite with 1 pair pores, 2 pairs microtrichiae (Fig. 10); venter with numerous minute, rough protuberances (=microtrichiae ?), and 1 pair of setae between coxae, almost on midline; spiracle annular, on stalked protuberance, ventrolateral near anterior margin, with seta on anteromesal margin of spiracular stalk. Metanotum similar to mesonotum; spiracle absent.



Figs. 11–14. *Stenichnus turbatus,* larval leg. 11, Coxa. 12, Trochanter and femur. 13, Tibia. 14, Tarsungulus. *a* = anterior seta; *al* = anterolateral seta; *ad* = anterodorsal seta; *av* = anteroventral seta; *d* = dorsal seta; *CX* = coxa; *pd* = posterodorsal seta; *mt* = microtrichia; *FE* = femur; *TI* = tibia; *tg* = tarsungulus; *v* = ventral seta.



Figs. 15–18. *Stenichnus turbatus,* abdomen. 15, Tergum III (dorsal). 16, Sternum III (ventral). 17, Segment IX (dorsal). 18, Segment X (dorsal). *asp* = acrosternal pore; *atm* = acrotergal microtrichia; *atp* = acrotergal pore; *d* = dorsal seta; *l* = lateral seta; *p* = posterior seta; *pv* = posteroventral seta; *pr* = pore; *v* = ventral seta; *vl* = ventrolateral seta; *vpr* = ventral pore; *av* = anal vesicle.

Leg (Figs. 11–14): Coxa (Fig. 11) large, ovate, with 9 anterior setae, 1 anteroventral seta, 5 ventral setae, 3 basal microtrichiae, and 1 anterior pore. Trochanter (Fig. 12) elongate, divided by unsclerotized "band" which extends around entire circumference and has 3 anterior and 2 posterior pores aligned on it; with single pore and seta on portion basad to band; with 1 pore, 2 anterior setae, 1 anteroventral seta, and 1 posterior seta on distal part. Femur (Fig. 12) elongate; with 3 anterolateral setae, 1 anterodorsal seta, 1 posterodorsal seta, 1 posteroventral seta, and 1 anterior pore. Tibia (Fig. 13) elongate, narrow; with 2 ventral setae, 1 posteroventral seta, and several spinose cuticular processes apically. Tarsungulus (Fig. 14) bisetose (1 seta posterior, 1 anteroventral); with 2 preapical spines on claw.

Abdomen (Figs. 15–18): Terga I–VIII subrectangular, much broader than long at midline; I–V subequal in length, VI–VIII gradually narrowed. Tergum III with anterolateral projection folded so that ventrolateral setae are directed ventrally; with 12 pairs of setae (2 dorsal, 6 posterior, 1 lateral, and 3 ventrolateral pairs of setae) and 2 pairs of pores (1 proximal to p2, 1 about midway between d2 and p5); acrotergite with 1 pair of pores, and 1 pair of microtrichiae (Fig. 15); spiracle inside stalked protuberance, projecting ventrally, arising at posterolateral angle. Spiracles I–VII subequal; spiracle VIII about ½ size of preceding ones. Sternum III with 3 pairs ventral setae, 5 pairs posterior setae; pores absent; acrotergite with 1 pair microtrichiae (Fig. 16). Tergum IX about twice as wide as long, narrowed posteriorly; with 6 pairs of setae (2 dorsal, 2 posterior, and 2 posterolateral pairs). and 1 pair of pores (Fig. 17). Sternum IX much shorter at midline than tergum, about 3× as wide as long; with 6 pairs of setae (3 ventral and 3 posteroventral pairs), pores absent; lateral margins each with 3 setae, progressively

Fig. 19. *Stenichnus turbatus,* lateral habitus, scanning electron micrograph of critical point dried specimen.

longer posteriorly. Segment X narrowed posteriorly; dorsum subquadrate with 2 pairs dorsal setae, 1 pair posterior setae, and 1 pair of pores (Fig. 18); venter much broader than long (ca. 2–3×), with 2 pairs of setae and 1 pair of pores proximal to v1 setae. Anal vesicle large, membranous.

Stenichnus conjux Casey

As in *S. turbatus,* except following structures: cervical membrane with cv3 and cv4 absent (see Fig. 3); pronotum with only 15 pairs of setae (setae p2, p4, d5, and d7 absent, see Fig. 9); mesonotum with only 10 pairs of setae (setae d3, p2, p4, and p7 absent, see Fig. 10); metanotum as mesonotum; tergum III with only 9 pairs of setae (setae p2, p4, and p5 absent, cf. Fig. 15); sternum III with only 7 pairs of setae (seta v2 absent, cf. Fig. 16).

Notes on Natural History

Scydmaenidae are believed to be specialized predators of mites (Crowson, 1981: 490), although there have been few studies on food selection, prey capture, or environmental factors affecting the distribution of scydmaenid beetles (cf. Brown and Crowson, 1979). Both of our larger series of *Stenichnus* were taken from conspicuously dry, decaying wood. Walter Suter indicates that associations of Scydmaenidae with dry habitats may be a more or less widespread phenomenon (personal communication). We made no direct observations of feeding for either collection, but one series (Q.W. Lot #8074) included an abundance of mites. It is interesting that species of the subgenus *Cyrtoscydmus* have been collected repeatedly by us and by Crowson, who has taken *S. collaris* in nearly every month

of the year, as compared with other scydmaenid taxa less frequently encountered; *S. turbatus* and *S. conjux* have been taken in equal numbers in the same habitat on two occassions. An abundance of *S. collaris* larvae in September and October suggested to Brown and Crowson (1979) that breeding is primarily in spring or early summer. Our collections of *Stenichnus* in October and May (and Crowson's other collections) indicate that larval overwintering may be a pattern in *Cyrtoscydmus.*

Discussion

We have used the term "pore" for minute, circular, cuticular structures which consist of a round sclerite, separated from the surrounding integument by a narrow, apparently membranous area. These structures may be campaniform sensillae, but until detailed studies are done, and to remain consistent with existing staphylinoid literature, we refer to them simply as "pores." Abdominal segment III was used as an exemplar, and detailed descriptions of the chaetotaxy of other segments were not made. It is possible that additional characters will be found on other segments. Segments IX and X show apparently random variation of patterns of setae, differing among individuals of each species. Our description of these structures is based on a single specimen of *S. turbatus.* We have used a system of letters and numbers, which are explained in the figure captions, to refer to setae, pores, and microtrichiae.

In most respects, *S. turbatus* and *S. conjux* resemble other known species of *Stenichnus* (Brown and Crowson, 1979). They differ from other *Cyrtoscydmus* (*S. pusillus* and *S. collaris*) in having nonserrate mandibles.

Our initial discovery of *Stenichnus* larvae here assigned to both *S. conjux* and *S. turbatus* in a ratio of 1:1 raised a question about what we were dealing with. Were there two species? Could there be two instars? Or, perhaps there were two semaphoronts of a single instar (such as sexual dimorphism). Collecting five specimens of one of these forms in association with adult *S. turbatus* caused us to hypothesize that this form was the larva of *S. turbatus,* and by elimination, that the alternative form was the larva of *S. conjux.* A corollary of this assumption is that both species occur together in the same microhabitats, and that the 50:50 ratios in two small samples were due to chance alone. Additional field collections will help to sort out the possibilities, and rearing may eventually provide a firm resolution. In the meanwhile, our inference seems consistent with the data, and provides relatively detailed descriptions of scydmaenid larvae, which include several characters of likely systematic and phylogenetic value hitherto unstudied. We are not in a position to analyze characters nor state their level of taxonomic importance. Our description does provide a basis for comparison, and emphasizes the great potential for larval studies in the Scydmaenidae.

Acknowledgments

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wood-decay, and forest litter at Cornell University (Q. Wheeler, principal investigator).

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